

REMARKS

By this amendment, claims 1-14 have been cancelled and claims 15-41 have been added. Thus, claims 15-41 are now active in the application. Reexamination and reconsideration of the application is respectfully requested.

The specification and abstract have been carefully reviewed and revised to correct grammatical and idiomatic errors in order to aid the Examiner in further consideration of the application. The amendments to the specification and abstract are incorporated in the attached substitute specification and abstract. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification by the current amendment. The attachment is captioned "**Version with markings to show changes made.**"

In items 3 and 4 on pages 2-4 of the Office Action, claims 1, 3-5 and 7-14 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite. This rejection is believed moot in view of the cancellation of the original claims 1-14. Furthermore, the new claims 15-41 have been carefully drafted to avoid the problems enumerated by the Examiner and to otherwise clearly comport with the requirements of 35 U.S.C. 112, second paragraph.

In item 1 on page 2 of the Office Action, the Abstract of the Disclosure was objected to for including language similar to that which formed the basis of the rejection under 35 U.S.C. 112, second paragraph. Accordingly, the Abstract has been revised to remove the objectionable language.

Regarding item 2 on page 2 of the Office Action, the phrase "folded back 6" has been changed to --folded-back portions 6-- in the fourth-to-last line on page 4 of the specification, in accordance with the Examiner's suggestion.

In items 5-8 on pages 4-6 of the Office Action, claims 1-3, 5, 6, 8-10, 12 and 13 were rejected under 35 U.S.C. 102(b) as being anticipated by Parrott et al. (GB 2,241,466); and claims 4, 7, 11 and 14 were rejected under 35 U.S.C. 103(a) as being unpatentable over Parrott et al. in

view of Rechsteiner et al. (U.S. 5,509,424). These rejections are respectfully traversed and are believed clearly inapplicable to the new claims 15-41, for the following reasons.

First, it is noted that each of the original independent claims 1, 3 and 5 specified that the "belt-like body ... is spirally wound." This term "spirally wound" was one of the terms which the Examiner enumerated as being indefinite, in the rejection under 35 U.S.C. 112, second paragraph. Neither of the Parrott et al. and Rechsteiner et al. patents discloses or suggests such a spirally wound belt-like material as required by the original claims. The term "spirally wound" is a common term used to describe the type of spiral structure disclosed in the present application. For example, attached are excerpts from U.S. Patent 3,846,202, European Application 0 574 371 and U.S. Patent 2,089,492, with portions thereof highlighted to show use of the phrases "spirally wound" and "spirally winding".

In any event, it appears that the Examiner gave no weight to the phrase "spirally wound" in the claims, since the none of the references disclose this feature.

With exemplary reference to the drawing figures, each of the new independent claims 15, 22 and 31 requires a noncombustible insulating duct comprising: an elongated strip 1 formed of an insulating material 2 and a noncombustible sheet 3 encasing the insulating material 2; wherein the elongated strip 1 is arranged in a spiral shape having a plurality of turns (see Figs. 1 and 4); wherein adjacent turns of the plurality of turns of the spiral shape are secured together so as to form a tubular duct (again see Figs. 1 and 4); and wherein the tubular duct is noncombustible.

In addition to the above requirements of the independent claims 15, 22 and 31, independent claim 15 specifies that the adjacent turns of the spiral shape are secured together by a bonding agent 7; independent claim 22 specifies that the adjacent turns of the spiral shape are secured together by a noncombustible joint member 5; and independent claim 30 specifies that the adjacent turns of the spiral shape are secured together by both a bonding agent 7 and a noncombustible joint member 5.

In contrast to the present invention of the independent claims 15, 22 and 31 the Parrott et al. reference merely discloses fire-resistant ducting composed of sheets or panels, but fails to

disclose or suggest forming a noncombustible insulating duct of an elongated strip arranged in a spiral shape having a plurality of turns.

The Rechsteiner et al. patent was cited by the Examiner for disclosing "a metal to metal structural joint between panels" and "caulking compound 40 ... applied between projection 20, leg 24 and recess 26 ...". However, the Rechsteiner et al. patent provides no teaching or suggestion that would have obviated the above-discussed shortcoming of the Parrott et al. reference.

For the above reasons, it is believed clear that the independent claims 15, 22 and 31 are not anticipated by the Parrott et al. reference. Furthermore, the distinctions are such that a person having ordinary skill in the art would clearly not have been motivated to modify the Parrott et al. reference or to make any combination of the references of record in such a manner as to result in or otherwise render obvious the present invention of claims 15, 22 and 31. Therefore, it is respectfully submitted that claims 15, 22 and 31, as well as the claims which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is earnestly solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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TITLE OF THE INVENTION:

NONCOMBUSTIBLE INSULATING DUCT

BACKGROUND OF THE INVENTION:

FIELD OF THE INVENTION:

This invention relates to a noncombustible heat insulating duct having both noncombustibility and insulating characteristics.

DESCRIPTION OF THE RELATED ART:

A duct provided in a building and used for air-conditioning, air discharging and ventilating purposes requires having a noncombustible structure under the Building Standards Act and the Fire Services Act.

A related art noncombustible duct of this kind used in practice is formed by winding glass wool to a predetermined thickness around an outer surface of a spirally wound steel wire or outer surfaces of regularly spaced ring type steel wires, and coating an outer portion of a resultant product with a noncombustible sheet.

Japanese Patent Laid-Open No. 243155/1997 which had opened to the public before the filing date of the application of the present invention discloses a noncombustible insulating duct formed by spirally winding noncombustible insulating fiber, such as glass wool around an outer side of a pipe of a spirally wound steel plate, and coating an outer side of a resultant product with a sheet material.

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However, out of these related art noncombustible insulating ducts, the former duct does not necessarily have a high noncombustibility. Moreover, since this duct is formed by winding glass wool around a spirally wound steel wire just as the ^{layer} ~~layer~~ wound around rolled rice of a ^{layer} ~~layer~~-wound "sushi", the productivity is low, and a duct of an arbitrary length cannot be freely obtained.

The latter duct disclosed in the patent laid-open publication does not have a flexibility in the spirally wound steel plate pipe, so that this duct has a problem concerning the workability thereof when the duct is drawn around inside a building. In order to obtain a required performance of this duct, it is necessary that the insulating fiber be wound in plural layers. Therefore, this duct also has a low productivity.

SUMMARY OF THE INVENTION:

Therefore, the object of the present invention is to provide a noncombustible insulating duct excellent in both the noncombustibility and insulating characteristics as well as productivity and, moreover, having flexibility.

The present invention also provides a noncombustible insulating duct having flexibility by spirally winding ^(i.e. arranging in a spiral shape) a belt-like body ^(i.e. an elongated strip) formed by wrapping an insulating material with a noncombustible cloth or some other noncombustible sheet type material. This enables a noncombustible insulating duct

capable of being manufactured continuously by using a mandrel, and freely to an arbitrary length to be provided.

The present invention further provides a noncombustible insulating duct excellent in productivity ~~by the structure that~~^{and of a for which} an operation for winding insulating fiber in plural layer^s is not required because the sufficient insulating characteristics is obtained by only a structure that ~~of~~^{is} wrapping^{ed} with an insulating material such as glass wool.

The present invention also provides a noncombustible insulating duct the flexibility of the whole of which is not lost even when a joint member formed of a metal plate is used, this joint member being merely wound spirally in a longitudinally spaced manner and different from the insulating duct that is wound around a spiral duct body of a steel plate.

The objects of the present invention and the effects obtained by the invention will be clearly understood from the following description given with reference to the drawings.
BRIEF DESCRIPTION OF THE DRAWINGS:

Preferred embodiments of the present invention will be described in detail with reference to the following figures, wherein:

Fig. 1 is a partially sectioned side view of the noncombustible insulating duct according to the present invention;

Fig. 2 is an enlarged view of a principal portion of what

is shown in Fig. 1;

Fig. 3 is a perspective view of a belt-like body; and

Fig. 4 is a partially sectioned side view of a noncombustible insulating duct showing ~~another mode~~ ^{a modified form} of the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Referring to Figs. 1-3, a reference numeral 1 denotes ^(i.e. an elongated strip) a belt-like body, a product formed as shown in Fig. 3, by coating, an outer circumferential portion of an insulating material 2 of, for example, noncombustible glass wool with a noncombustible cloth or some other noncombustible sheet type material 3 in order that a cross section of the belt-like body becomes substantially square. This belt-like body 1 is provided at inner side corners of both of widthwise end portions thereof with flanges 4 which are made integral with and project from the sheet type material 3, and which extend in the longitudinal direction.

A reference numeral 5 denotes a joint member in the present invention, which is formed of a metal plate, for example, a stainless steel plate or some other noncombustible flat plate material. Both of lateral edge portions of this joint member 5 are ^{formed into} ~~folded-back~~ ^{portions} ~~to the same surface of the joint member~~ ^{that are folded back} so that the joint member has a generally U-shaped cross section. ^(i.e. arranged in a spiral shape) The joint member 5 is wound spirally with the belt-like body 1 so that the surface of the joint member which is on the side

of the folded-back portions 6 faces an inner surface of the belt-like body 1.

During this winding operation, a flange 4 at a preceding edge portion of the belt-like body 1 is wound in the inside of one folded-back portion 6, and a flange 4 at a following edge portion of the belt-like body 1 ^{is wound} in the inside of the other folded-back portion 6. These folded-back portions are then caulked, and the flanges 4 wound in the inside of the ^{That is, the folded-back portions 6 of the joint members 5 are secured on adjacent flanges 4 of adjacent turns of the spiral-shaped body 1} folded-back portions 6 are thereby clamped or embraced. The adjacent end portions of the belt-like body 1 are thus connected together.

In this embodiment, the inner side portions of the belt-like body 1 are connected together by joint members 5 but the outer side portions thereof are not. Therefore, in order to prevent the outer side portions of the belt-like body from being opened and separated, the opposed end portions thereof are bonded to each other with a noncombustible bonding agent 7. In this case, it is also possible to provide the flanges 4 on outer circumferential side of the belt-like body 1, and connect the adjacent end portions of the belt-like body together by using the joint members 5 in the same manner as mentioned above.

~~The~~ glass wool and rock wool can be ^{form} ~~named as~~ the insulating member 2 having ~~a~~ noncombustibility, and an aluminum glass cloth, aluminum foil, a nonflammably treated resin film, a

glass cloth the pores of which have been filled and coated with a silicon resin, a fire proof processed nonwoven cloth, a nonflammably treated mixed woven cloth, and a mica sheet can be used as the noncombustible sheet material 3. Especially, in the case of a glass cloth, the use of fibers of a large diameter causes the flexibility of the cloth to be lost, and the cloth ~~to~~^{may} be broken when it is bent. Therefore, it is desirable that fibers of a comparatively small diameter be used.

The bonding agent 7 can be formed of, for example, a noncombustible bonding agent using inorganic silicate. Even such a small quantity of organic bonding agent with low noncombustibility that does not cause the noncombustibility of a duct as a whole to be lost can be used.

Fig. 4 shows a noncombustible insulating ^{tubular} duct formed by connecting adjacent ~~end portions of a belt-like body 1~~^{turns of the spiral-shaped} to each other with only a bonding agent 7 without using joint members 5. In this case, such a small quantity of organic bonding agent that does not cause the noncombustibility of the duct to be lost can also be used but it is desirable that such an inorganic noncombustible bonding agent as mentioned above be used.

The above is a description of a preferred embodiment of the present invention but the present invention is not limited to this embodiment. The present invention can be modified variously within the scope of the following claims, and it

should be noted that such modified embodiments are also included in the present invention.

ABSTRACT OF THE DISCLOSURE:

A flexible insulating duct ^{has} excellent ~~in both the~~ noncombustibility and insulating characteristics as well as productivity, and ^{is} formed by ^{an elongated spiral body having plural turns} ~~spirally winding a belt-like body~~ ^{and} which ^{is} obtained by wrapping glass wool or some other insulating material with a noncombustible cloth or some other noncombustible sheet type material. When the ~~belt-like~~ ^{spiral} body is ~~spirally~~ wound, a preceding ^{turn} ~~end portion~~ thereof and a following ^{turn} ~~end portion~~ thereof are bonded to each other so that the noncombustibility of a final product is not lost, or ^{are} joined to each other firmly via a noncombustible joint member.